

stereo isomerism; the essential part of it is retained in the assumption that the carbon atom is stereo-chemically to be regarded as tetrahedral in shape. If any student carries away the notion that this is believed to be the actual shape of the atom, there is no more mischief done than in that student's case who gathers the impression that the two carbon atoms united by an ethylene linkage are held together by two pairs of forces which do not act along the line joining the two atoms, but meet at an angle in empty space. G. S. TURPIN.

Huddersfield, September 24.

Careless Writing.

PROF. HILDEN, in his review, published in NATURE, September 20, takes exception to the loose phraseology adopted by writers on chemical subjects. This is, alas! only too common.

For example, in one of the best works on inorganic chemistry, written by a Professor of Chemistry whose writings are characterised by their logical clearness and philosophic reasoning, one may read:—

"When a molecule of hydrogen acts upon a molecule of chlorine to form two molecules of hydrochloric acid gas, 44,000 c. of heat are evolved." Of course, nobody can fail to understand what is meant. But as the words stand, it is certainly one of the most remarkable feats of science, and makes us feel that some happy mortal has succeeded in refining his faculties down to the degree of fineness, popularly ascribed only to a certain species of "demon." F. G. DONNAN.

Hollywood, Belfast.

ON THE DOCTRINE OF DISCONTINUITY OF FLUID MOTION, IN CONNECTION WITH THE RESISTANCE AGAINST A SOLID MOVING THROUGH A FLUID.¹

II.

§ 6. IN every case in which vacuum is formed at an edge of a solid moving in an inviscid incompressible fluid, under pressure constant at all infinitely great distances from the solid, a succession of finite individual vortices is sent from the edge into the liquid, and the motion is essentially unsteady. Each individual vortex has a finite endless vacuum for its core instead of the rotationally moving ring of fluid of the Helmholtz vortex ring. But it should be noticed that it would not be rings of vacuum, but bubbles, that would in many cases be first detached from the solid; that by the tumultuous collapse of bubbles they become rings; and that the case in which the collapse of a bubble, in our ideal fluid, could be completed to an annulment of volume, is of necessity infinitely rare; and that the case in which, when a bubble becomes a ring by the meeting of two points of collapsing boundary, there is exactly no circulation through the aperture, is infinitely rare.²

§ 7. In the case of our circular disc, it would be circular vortex rings that, if the water were inviscid, would be shed off from its edge when the depth is less than 63 feet. If the depth is very little less than 63 feet these rings would be exceedingly fine, and would follow one another at exceedingly short intervals of time. Thus quite close to the edge there would be something somewhat like Stokes' "rift," but with a rapid suc-

cession of vacuum rollers, as it were; and no slipping between the portions of the fluid on its two sides.

§ 8. At greater depths than 63 feet, if the water had absolutely no viscosity,¹ the motion would be continuous and irrotational, as described in § 4, text and foot-note: but any degree of viscosity, however slight, would, if the edge were infinitely sharp (instead of having a radius of curvature of $1/2000$ of an inch, as has our supposed disc), give rise to a state of motion in its neighbourhood somewhat like to Stokes' rift,² "a surface of discontinuity extending some way into the fluid," but with the difference that there is no slip of fluid on fluid. A trail of rotationally moving liquid, a Helmholtz "vortex sheet" of exceedingly small thickness, is thus left in the wake of the circular edge; which, while becoming thicker as it gets farther from the edge, becomes rolled up in a wildly tumultuous manner, giving the appearance of an irregular crowd of detached circular ring-vortices. This crowd follows the disc at an ever diminishing speed and widens outward farther and farther, and inwards encroaches more on the comparatively undisturbed middle of the wake, as it is left farther and farther behind the disc.

§ 9. Whether as in § 7 for an ideal inviscid incompressible fluid, or as in § 8 for a natural liquid such as water, the "wake," that is to say, the fluid on the rear side of the plane of the disc, as far as it is sensibly affected by the motion of the disc, must be as described in the last sentence of § 8. The rear of the wake is always moving forwards, that is to say, following the disc; but at a continually diminishing speed. Hence, if the disc has been set in motion from rest some finite time, t , ago, the whole wake must be included between the plane from which the disc started, and the plane in which the disc is now, at the time when we are thinking of it. These two planes are at the finite distance, Vt , asunder. In other words the wake extends to some distance less than Vt , rearwards from the disc.

§ 10. The shedding off of vortex rings from the edge of the disc, to follow in its wake at less speed than its own, essentially gives a contribution to negative pressure on the rear side of the disc equal to $\frac{d}{dt} \Sigma \kappa$; where $\Sigma \kappa$ denotes the sum of the circulations of all the coreless ring vortices, or of all the rotationally moving liquid, which have or has left the edge since the beginning of the motion. This, with the commonly assumed velocities of the fluid on the two sides of the rigid plane, seems insufficient to account for the excess of observed pressure above that calculated for a long blade by Lord Rayleigh's formula³ referred to in my letter to NATURE, "Towards the Efficiency of Sails, &c.," and leaves some correction to be made on those assumed velocities. But the working out of this interesting piece of mathematical hydrokinetics must be deferred for a continuation of the present article in which supposed discontinuity of fluid motion, extending far and wide, as taught by many writers in many scientific papers and text books since Stokes' infinitesimal rift started it in 1847, will be considered. KELVIN.

(To be continued.)

MR. SCOTT ELLIOT'S RUWENZORI EXPEDITION.

ABOUT three years ago, in NATURE (November 5, 1891), I gave an account, rescued from an American periodical, of the botanical results, slender enough it is true, but not without interest, of the Emin Relief Ex-

¹ Viscosity is resistance to change of shape in proportion to the speed of the change.

² Stokes, "Mathematical and Physical Papers," vol. i. p. 310.

³ In lines 9 and 10 of the printed letter (NATURE, Aug. 20, 1894, p. 426), for "something like five or ten," substitute 4.8. I unfortunately had not Lord Rayleigh's formula by me at the time the letter was written.

¹ Continued from p. 525.

² The whole subject of the motion of an incompressible inviscid fluid with vacuum on the other side of the whole or any part of its boundary is of surpassing interest. Consider for example an open fixed basin, with water poured into it and left not quite at rest under the influence of gravity; swinging slightly from side to side; let us suppose for example; the water perfectly inviscid, and vapour-less, but may be either cohesionless or cohesionless; and there being perfect vacuum over all its free surface. Very soon it will certainly throw up a drop somewhere; and before very long it will become covered with spin-drift and will thus illustrate Maxwell's important allegation (which I believe to be true though it has been much doubted), that any conservative system must "sooner or later" pass through every possible configuration.

pedition, as described by Major Jephson. The most important feature was undoubtedly the small collection brought away "for Emin Pasha to classify" by Lieut. Stairs from "a high altitude on the slopes of Ruwenzori, or the Mountains of the Moon."

Last year Mr. Scott Elliot, an accomplished botanist and experienced African traveller, submitted to the Government Grant Committee of the Royal Society a scheme for an extended plan of botanical exploration in Central Africa. On the advice of the Board for Botany, Mr. Scott Elliot undertook the investigation of Ruwenzori, and through the kind aid of Sir John Kirk, such official facilities as were possible were obtained on his behalf.

Mr. Scott Elliot, not without many difficulties, has now reached his destination. The following letter, which is communicated to NATURE at his request, raises a high expectation that he will succeed in thoroughly investigating the flora of this interesting region. It is a matter of sincere hope that his health will be spared for the task. Unfortunately the time is far distant when, as prophesied by Mr. Stanley, the "tender-hearted botanist" may be "conveyed from point to point without danger to his valuable life." The honour is all the greater to a man of by no means robust physique, who in the pure interests of science is willing to take his life in his hand in the prosecution of such a task.

W. T. THISELTON-DYER.

Royal Gardens, Kew, September 25.

Ruwenzori, May 2, 1894.

I arrived here on April 1, but have unfortunately been able to do very little, as I have had severe fever. I may not have another opportunity of writing for a long time, so send this now. My route has been through Kavirondo, Usoga, and Uganda to Buddu, through Buddu to Karagwe, and thence diagonally across Ankobe to Toru. I find Uganda, Buddu, and Toru to consist of a plateau apparently gneiss and granite, about 4000-4500 feet high in most parts, but about this part of Toru 5000 or even 5300 feet. The whole of this plateau is cut up into innumerable swampy rivers, due to the comparative slow gradient of these rivers (the Victorian Nyanza being only 3850 feet). In Karagwe and Ankobe this plateau is covered by a series of folded schists and shale which extend with one break from Kitangule to within eight miles of the Albert Edward Nyanza, where the granite plateau is reached again. These schists are at 80°-90° dip, and strike usually 20°-30° east of north. A curious little chain of small volcanic craters, running east and west nearly, appears in the midst of the granite at Vijongo (on Lugard's map), that is, at the base of Ruwenzori, but I have not been able as yet to see much of the geology of Ruwenzori itself. The flora over the whole of this country up to 6000 feet is identical, and even at 6000 feet there are but few new species. It seems probable to me that this flora extends right down to the Zambesi. I have been able to get a fair number of species representing it, but in what condition they will reach England remains to be seen. Of trees there are very few. A tree *Euphorbia* and an *Erythrina* are the commonest. The most objectionable is a bamboo-like grass, often twenty feet high, which makes travelling most annoying. Another conspicuous plant is an *Acanth* with handsome red spikes of flowers and very large prickly leaves. There are two or three *Helichrysums*, numerous *Comelinas* and twining *Leguminosæ*, and, strangely enough, a *Rubus*, a buttercup, and three *Umbelliferae*. I find also the same beetles, butterflies, and dragonflies everywhere.

The country as a whole seems very fertile, and the population is probably one-hundredth part of what it might be. The swamp rivers alluded to are probably the most extensive natural rice-fields in the world; but rice has only been grown in a very half-hearted manner. The banana

supplies all the wants of the people. Tobacco could also be grown anywhere, and, as far as one can judge from the native plant, a very good kind could be produced. Coffee could also be grown, and cotton, and, in fact, most of the common tropical plants. Kasamaga, the king here, tells me he wants Europeans to settle here and teach his people; and a young fellow who is disposed to rough it, and fond of sport, might do very well here at Ruwenzori. He could support himself the first few years by ivory (shooting and trading), and by the time his plantation came into bearing there ought surely to be communication with the coast. A curious fact in natural history has come about here. Kabbarega has eaten up all the cattle in the country. There is scarcely a fowl left, and in consequence lions and leopards have taken wholesale to man-hunting. They have completely changed their manner of hunting in accordance with this. Usually speaking they are continually roaring on the trail, but here neither ever utters a sound, and though I have had two men injured, and been within a hundred yards of another man who was carried off, I heard nothing.

Mapping is very difficult here; the compass shows the most extraordinary variations, and the rivers are almost impossible to trace, even from a great height, as where I am now.

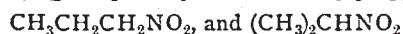
I have not been able yet to get at the higher flora. One curious fact is that the woods on Ruwenzori very closely follow the ordinary morning clouds and mists: these are usually at the same line every morning, and mount to the top towards evening. This line of wood or cloud is not, however, horizontal, but is highest at the main mass, and slopes gradually as the mountain chain sinks in height.

(Signed) G. F. SCOTT ELLIOT.

THE PHYSIOLOGICAL ACTION OF THE PARAFFIN NITRITES.¹

THE valuable investigations described in this communication to the Royal Society have been made to determine more exactly the mode of action of paraffin nitrates, and the part which the nitroxyl group NO₂ plays in their physiological action, and also to throw light on the effect of variations in their molecular constitution. For these objects a series of careful observations have been made as to the action of ten of the fatty nitrates on (1) blood pressure, (2) pulse frequency, (3) respiration, (4) striated muscle tissue.

The compounds selected for examination included the nitrates of methyl and ethyl, the primary and secondary propyl nitrates, the primary, secondary, and tertiary butyl nitrates, and three amyl nitrates (α and β isopropyl, and tertiary amyl nitrate). By this selection it has been possible to compare the action of a series of substances containing an atom of NO₂ united respectively to CH₃, C₂H₅, C₃H₇, C₄H₉, and C₅H₁₁, and thus to determine the modifying influence which these radicals exert on the action of the NO₂ group. It has also been possible to ascertain the effect produced by a modification of arrangement of the molecules in nitrates having the same composition as, e.g. in primary and secondary propyl nitrate,



It has long been known that the fatty nitrates lower blood pressure, but opinions have differed as to their mode of action, Filehne considering that this lowering is caused by a parietic influence on the vasa motor centres, whilst Brunton looks upon it as due to a direct effect on the vessels themselves. Cash and Dunstan are led by their experiments to range themselves on the side of

¹ *Phil. Trans.* vol. clxxxiv. (1893), B, pp. 505-539. A paper by Dr. J. Theodore Cash F.R.S., and Prof. Wyndham K. Dunstan.